

CLAIMS

1. A method for loading and exchanging respective rollers of a plurality of printing units of a printing machine, wherein the printing machine includes a plurality of printing units in a sequence such that an item to be printed moves successively through the printing units in the sequence, and each printing unit includes a replaceable engraved roller and a cooperating printing cylinder which are operative together to apply printing to the object passing through the printing unit,

the method comprising:

bringing a first engraved roller to a loading station located at an entry to the sequence of printing units;

operating a controllable robot to bring the first engraved roller from the loading station into an unloading position for the engraved roller located at a respective one of the printing units;

bringing a second engraved roller to the loading station;

operating the robot to bring the second engraved roller to a reserve station for engraved rollers located at the respective one of the printing units;

operating the robot to bring additional first engraved rollers to the loading station;

operating the robot to successively bring the additional first engraved rollers to the unloading position of each of the printing units and operating the robot to successively bring second engraved rollers to the respective reserve station at each of the printing units;

operating the robot to bring one of the first engraved rollers at one of the printing units to a transport device and operating the transport device for bringing the one first roller to a working position where it cooperates with a respective printing cylinder to enable printing of an object between the one first roller and the printing cylinder;

positioning and fixing the one first engraved roller in the working position in its respective printing unit;

the method further comprising exchanging one of the first engraved rollers then located at the working position at one of the printing units comprising:

withdrawing the one first engraved roller that is to be exchanged from the working position thereof at the respective printing cylinder in the one printing unit;

transporting the withdrawn first engraved roller by a transport device into an unloading position at the one printing unit;

operating the robot to bring the first engraved roller to be exchanged from the unloading position off the transport device to an unloaded storage location;

operating the robot to move the second engraved roller from a reserve location to the transport device on the respective one printing unit and disposing the second engraving roller to the transport device of the one printing unit, and operating the transport device to bring the second engraved roller to the working position at the printing cylinder of the one printing unit, and fixing the second engraved roller at the working position.

2. The method of claim 1, wherein the printing machine has an initial loading station for engraved rollers, an initial storage station for the engraved rollers following the loading station in sequence, and a respective reserve station for engraved rollers at each of the feeding units,

the method further comprising initially bringing each of the engraved rollers to the loading station and by a robot bringing the engraved rollers either into the storage station, or bringing each engraved roller directly to a respective reserve station located at one of the printing units, or into the unloading position at the respective one of the printing units;

the method further comprising repeating the foregoing steps for bringing successive engraved rollers to each of the other printing units and operating the robot to introduce each of the successive engraved rollers from the loading station to a respective reserve station at each of the printing units;

wherein the robot is also operable for moving each of the engraved rollers onto one of the transport devices and operating the respective transport device to bring each engraved roller by the respective transport device from an unloading position to the working position thereof and fixing the engraved roller at the working position thereof in the respective printing unit.

3. The method of claim 2, wherein following the withdrawal of an engraved roller to be exchanged from the working position thereof and by the transport device moving that engraved roller into an unloading position, the method comprising

operating the robot to move the engraved roller to be exchanged from the unloading position thereof to either the reserve station at the respective printing unit, or to a location of a storage station preceding the printing units, and

operating the robot to bring the second engraved roller from the storage station or from the reserve station at the printing unit into the unloading position and then operating the transport device to move the second engraved roller to the working position.

4. A method for exchanging an engraved roller of a printing unit of a printing machine having a succession of the printing units for printing objects in sequence, wherein each printing unit includes a respective engraved roller and an opposing printing cylinder located at a working position which are operative together to apply printing to an object passing through the printing unit,

the method for exchanging a first engraved roller on the printing unit with a second engraved roller comprising:

withdrawing the first engraved roller that is to be exchanged from the working position thereof at the respective printing cylinder;

transporting the withdrawn first engaged roller by a transport device of the printing unit into an unloading position at the printing unit;

operating a robot to bring the first engraved roller to be exchanged from the unloading position off the transport device to an unloaded storage location;

operating the robot to move a second engraved roller from a reserve location at the respective printing unit to the transport device of the respective printing unit and disposing the replacement engraving roller to the transport device of the printing unit, and

operating the transport device to bring the second engraved roller to the working position at the printing cylinder and fixing the second engraved roller at the working position thereof.

5. Apparatus for loading and exchanging engraved rollers of printing units of a printing machine, wherein the printing machine comprises a plurality of the printing units in succession along a path through which objects to be printed at the printing units pass, and the apparatus including a loading station for engraved rollers, the loading station preceding the printing units;

a moving device for moving a first engraved roller from the loading station to the respective printing unit;

a further device at the printing unit then operable for moving the first engraved roller to a working position at the printing unit where the first engraved roller is in a position to print an object:

the moving additionally being operable to move among the printing units to enable withdrawal of one of the first engraved rollers from any of the printing units, and the moving device being operable for moving to the respective printing unit where a first engraved roller is to be removed, for engaging the first engraved roller to be removed and for withdrawing the first engraved roller from the working position, for moving the first engraved roller to a loading and unloading position where it may be transported and for bringing that first engraved roller into a storage location; and

a control device for controlling operation of the apparatus.

6. The apparatus of claim 5, further comprising

a respective reserve station for engraved rollers at each of the printing units;

the moving device being operable for holding an engraved roller and for transporting that engraved roller from a storage station to a respective reserve station at each of the printing units and also to the respective working position for the engraved roller at each of the printing units and operable for moving a first engraved roller withdrawn from its working position either into the reserve position at the respective reserve station at the printing unit or to the storage station.

7. The apparatus of claim 6, further comprising a respective transport device at each of the printing units operable for transporting a first engraved roller between a loading position and an unloading position away from the working position of the printing roller in the printing unit.

8. The device of claim 7, wherein the moving device for moving the roller from the loading station to each of the printing units comprises a robot movable from the loading station selectively to each of the printing units, the control device being operably connected with the robot for causing the movement of the robot;

the robot including an engraved roller positioning device thereon, for moving an engraved roller to a position where the robot can transport the engraved roller to and past each of the printing units, and the positioning device being operable at each of the printing units to move an engraved roller at the printing unit to the loading and unloading position and then to move the roller away from the loading and unloading position to enable the robot with the engraved roller supported on the robot to move through the apparatus past the printing units.

9. The device of claim 5, wherein the moving device for moving the roller from the loading station to each of the printing units comprises a robot movable from the loading station selectively to each of the printing units, the control device being operably connected with the robot for causing the movement of the robot;

the robot including an engraved roller positioning device thereon, for moving an engraved roller to a position where the robot can transport the engraved roller to and past each of the printing units, and the positioning device being operable at each of the printing units to move an engraved roller at the printing unit to the loading and unloading position and then to move the roller away from the loading and unloading position to enable the robot with the engraved roller supported on the robot to move through the apparatus past the printing units.

10. The apparatus of claim 9, further comprising a guide rail extending from the loading station past each of the printing units, and the robot including a cooperating guide element such that the robot is movable along the rail.

11. The apparatus of claim 10, wherein each of the printing units has a lower part located under the loading and unloading position for the engraved rollers and under the working position thereof, and the rail passes beneath the loading and unloading positions and the working positions of the printing units for transporting an engraved roller below those positions and to the printing units.

12. The apparatus of claim 11, wherein the rail includes a rack, a driven pinion gear on the robot with a motor drive to the pinion gear to move the robot along the rack.

13. The apparatus of claim 10, wherein the robot includes a lifting device operable on the robot for lifting the engraved roller supported on the lifting device between the loading and unloading position at the printing unit and a lowered position selected so that the robot may move the engraved roller to and past the respective printing unit.

14. The apparatus of claim 13, wherein the positioning device on the robot is comprised of a pair of levers in X form and a bedplate on which the levers are supported, a base in turn supported by the levers including support elements on the base for the engraved rollers, and a drive on the robot for moving the X form levers to selectively raise and lower support elements for the engraved roller moving device.